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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2016

B.Tech VI Semester

COURSE CODE: 10B11CE611 MAX. MARKS: 35

COURSE NAME: Design of Steel Structures

COURSE CREDITS: 4 MAX. TIME: 2 HRS.

Note: *All questions are compulsory.*

Carrying mobile phone during examinations will be treated as case of unfair means.

Illustrate your answers with neat sketches / free body diagrams wherever necessary.

For any missing data or information, you are free to make whatever simplifying assumptions that you wish, ***provided you supply a credible justification****.*

Cite the appropriate ***clause no., table no. and figure no. from IS codes****, wherever it is required.*

Assume the loads are given as ***factored****, unless noted otherwise.*

Preferably, write the answers in sequential order. ***IS 800: 2007, IS 1161: 2014, IS 808, Steel Table*** *is allowed.*

Q.1 Answer the following questions in brief. **[5 X 2 Marks = 10 Marks]**

A. State all the possible conditions, when a steel beam can be assumed as ***Laterally Supported***.

B. How does the presence of ***residual stress*** affect the design of steel structures?

C. ***Elastic lateral torsional buckling moment (M_{cr})*** is calculated according to the ***cl.8.2.2.1 of IS 800: 2007*** using the following expression:

$$M_{cr} = \sqrt{\frac{\pi^2 E I_y}{(L_{LT})^2}\left[GI_t + \frac{\pi^2 E I_w}{(L_{LT})^2}\right]}$$

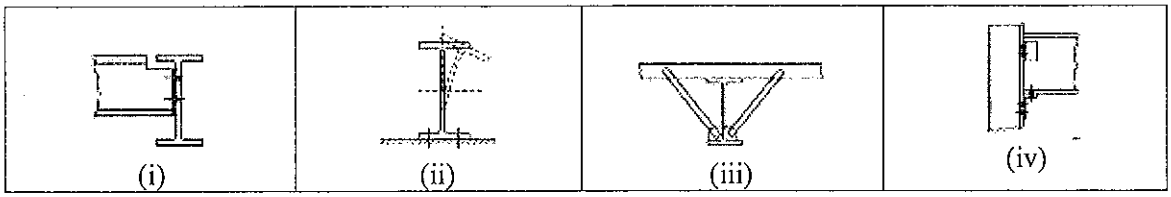
This expression is valid for the following assumptions:

(i) Bending moment should be ***constant*** throughout the length.
(ii) Cross section of the beam should be ***doubly symmetric***.
(iii) The member should be ***prismatic***.
(iv) End conditions of the beam should be ***simply supported***.
(v) Load should be applied through the ***shear center***.

Explain the corrections required when the above mentioned assumptions are violated.

D. Explain **Normal** and **Destabilizing** loading conditions associated with calculation of L_{LT}.

E. Identify the following support conditions according to ***Table 15 of IS 800: 2007*** and also mention the effective length L_{LT} for the destabilizing loading condition.

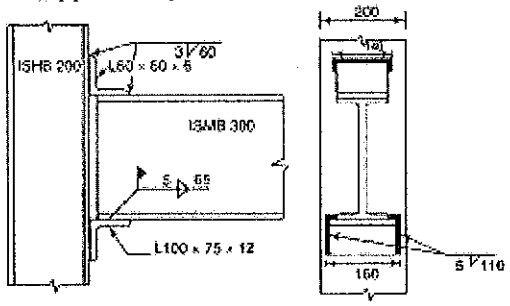


2. Design a simply supported beam of 6.0 m span carrying a uniformly distributed dead load of 45 kN/m and live load of 25 kN/m. Select an appropriate hollow tube section of YST 310 grade of steel. The maximum permissible live load deflection is given as L/360. (Shape factor of circular tube section =1.7) **[5 Marks]**

3. A ground floor column in a multi-story building having column length 4m has been designed with ISHB @ 82.2kg/m. The frame is moment-resisting in-plane and pinned out-of plane, with diagonal bracing provided *only* in out-of plane direction to restrict its sway. The column is subjected to an axial load of 500 kN due to two beams framing into it. The beam connected to the flange has a load of 200 kN at an eccentricity of 200 mm and the other beam connected to the web of the column has an eccentric load of 300 kN at a distance of 100 mm. Comment on the adequacy of the column considering ***overall member strength check***.
For a member of 4m with ISHB @ 82.2kg/m section, the flexural and compression capacities are given as follow:
$P_{dz} = 2341kN, P_{dy} = 1615kN, M_{dz} = 337.862kNm, M_{dy} = 92.59kNm$ **[6 Marks]**

4. Design the base plate for a circular tube post with NB 300 section to carry a factored load of 1200 kN. The thickness of the tube is given as 12 mm. Assume Fe 410 grade steel for base plate and M20 grade of concrete for RC pedestal. Provide details of column to base connection in a neat and clean sketch. **[4 Marks]**

5. The details of a beam to column connection are shown the following figure. Determine the maximum reaction that can be supported by this connection. **[5 Marks]**



6. Design a single angle discontinuous strut to carry a factored load of 100 kN. Assume that the distance between its joints is 2.5 m. Use Fe 410 grade of steel. **[5 Marks]**